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Sustainable Mobility

Study Material

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INTRODUCTION

Sustainable development is a society-wide issue to which long-term attention has been paid. It is emphasized at the transnational level, represented for example by the United Nations (UN) or the Organization for Economic Co-operation and Development (OECD). In the European context, it is addressed at the level of the European Union (EU). This international action is reflected at the national level where the topic of sustainable development is dealt with in a number of strategic plans and is further addressed at the regional and local level.

The issue of sustainable transport is naturally linked to the topic of sustainable development. Transport conditions development at the economic and social level, but it is understood as an element that undermines sustainable development – especially at the environmental level. There is an effort to find an appropriate consensus. Finding it is difficult, given that it is a multidimensional concept. There are four basic levels meeting in this concept – it emphasizes social, economic, environmental, and institutional issues. Within these four levels, the concept of sustainable transport is closely intertwined with the issue of sustainable development. It shares with it its hard-to-define and complex focus on a wide range of activities and, like this issue, it faces a discrepancy between defined theoretical approaches and their practical application.

The complexity of the concept, together with unanchored principles for practical implementation, leads to the creation of several different systems at the international level, at the level of individual EU member states, as well as at the level of individual regions and municipalities in the given countries. This disharmony is partly due to the novelty of the concept. In order to be able not only to understand the concept more deeply, but also to use it, it is necessary to find instruments that will make the issue easier to understand, direct future developments and monitor any changes.

Sustainable mobility is a multidimensional concept in which four basic elements meet each other – it accentuates social, economic, environmental, and institutional issues. This concept of sustainable mobility closely blends with sustainable transportation and sustainable development issues in the above-mentioned four elements blending. This concept shares with the other two above-mentioned issues their complex and hard to define nature – it focuses on a wide range of activities. Similarly, as the two above-mentioned issues it struggles with a conflict between defined theoretical approaches and their practical application. An adequation gap is thus opening here.

Complexity of the concept jointly with „unanchored“ principles for practical implementation leads to creation of a whole range of different systems on international level, on individual EU member states level as well as on individual regions and municipalities' levels in given countries. This disharmony is partially caused by newness of the concept. Sustainable mobility is an issue that has not yet been submitted to thorough and detail research unlike other sustainable development areas. No specific implementation tools have been created on a wider scale for this issue so far.

In order to be able to understand this concept more deeply as well as be able to use this concept it is essential to find instruments that will enable us to understand this issue better, to orientate future development and to observe any changes. Indicators seem to be suitable instruments for meeting this end. Indicators may make the implementation of sustainable mobility easier thanks to the fact that they are a suitable tool not only for an analysis, an evaluation and monitoring but they are also suitable for communication.

The study material focuses on developing the key knowledge and skills needed to understand and apply the principles of sustainable transport. It systematically links the four pillars of sustainable development - environmental, economic, social and institutional - and provides a theoretical framework, case studies and practical tools for planning and managing transport systems in accordance with the principles of sustainability. This material provides students with a foundation for analysing, designing, and implementing sustainable transportation solutions that contribute to protecting the environment, boosting the economy, and improving quality of life.

GREEN KNOWLEDGE AND SKILLS: THE KEY TO SUSTAINABLE MOBILITY

The study material "Sustainable Mobility" focuses on the key green knowledge and skills needed to support the economic transformation according to the principles of the European Green Deal. The document systematically develops a multi-disciplinary approach to sustainable development and its four pillars (environmental, economic, social, and institutional) and their links to transport. Through theoretical definitions and case studies, it offers a comprehensive approach to achieving sustainability in the transport sector.

In terms of the environmental pillar, it emphasizes the reduction of negative externalities such as emissions, noise or landscape fragmentation and promotes the introduction of innovative regulatory measures. The economic pillar emphasizes the use of capital to support innovative processes and efficient transport planning, considering the 3E principles (economy, efficiency, effectiveness). The social pillar focuses on eliminating social exclusion and ensuring accessible mobility for all population groups. The institutional pillar highlights the key role of public administration in providing transport services and financing public goods.

It also introduces practical tools and methods for sustainable transport planning, such as the SMART method for goal setting, situational analysis, or mobility management, which reflect the objectives of the European Green Deal.
The content of the material thus prepares students for the application of these principles in practice and supports the development of sustainable solutions at local and transnational government level.

The learning support responds to key areas of green knowledge and skills and provides a basis for understanding and applying the principles of sustainable development in transport. Aspects that are newly incorporated and respond to the current direction of green knowledge and skills are highlighted below.

Climate change and the principle of decoupling

The support addresses climate change through the economic pillar and the decoupling principle, which focuses on decoupling economic growth from negative environmental impacts. This includes efforts to promote economic development while reducing emissions and other negative externalities.

Carbon footprint and its reduction

Promoting active mobility such as cycling, walking and the use of public transport contributes to reducing the carbon footprint. These measures are mentioned in the section on the social pillar.

Innovation and technology

Innovation and smart solutions are discussed in the section on SMART approaches such as Intelligent Transport Systems (ITS), carsharing or dynamic transport planning. These technologies increase the efficiency and promote the sustainability of transport systems.

Behavioral changes
Behavioral aspects such as changes in traffic behavior and safety promotion are discussed in the section on traffic safety. This includes measures to improve conditions for active mobility and increase safety for pedestrians and cyclists.

Financing green transport
Financing is mentioned in the institutional pillar, where for example the Mobility Fund is mentioned, which supports sustainable transport at both public and private sector level. This section reflects the key role of financing in the implementation of transport projects.

Monitoring and impact assessment
The strand uses indicators to monitor and evaluate transport projects. This method is essential to determine the effectiveness of implemented measures and their alignment with the SDGs.

Global context and inspiration from other countries
Examples of good practice, such as the project in Amsterdam on emission-free logistics, illustrate the global approach to sustainable transport and provide inspiration for applying similar principles in other regions.

Practical projects and student involvement
The support includes a separate chapter dedicated to a student project that aims to apply the knowledge gained in practice. This encourages active involvement of students in solving real transport challenges.

This approach makes the study material well balanced and compatible with the requirements of the European Green Deal, while at the same time providing students with the skills to plan, manage and evaluate sustainable transport projects in a real environment.

It responds to the surveys carried out in 2023 as part of the European Year of Skills. According to the surveys carried out, knowledge is important to help change user behavior, promote active forms of transport and take advantage of digitalization. Effective communication and the ability to cooperate with stakeholders and the public were among the important skills. Skills that students can actively practice in the preparation of the study.

1 SUSTAINABLE DEVELOPMENT AND SUSTAINABLE MOBILITY

Introduction

Sustainable development has been a subject of research for decades, yet there is no clear definition thereof and understanding of this area is constantly changing. The situation is similar with the issue of sustainable transport – its characteristics vary according to the context in which sustainable mobility is discussed.

Your goals

The goal of the chapter is to get acquainted with the essence of sustainable development and sustainable mobility and with the basic areas – pillars – that characterize them.

1.1 CHARACTERISTICS OF SUSTAINABLE DEVELOPMENT

Sustainable development is understood as a new paradigm of the development of science, politics and law. Its general definition says that it is "*development that meets the needs of present generations without compromising the ability of future generations to meet their own needs, and without doing so at the expense of other nations.*"

The definition used in the Czech legal environment is based on Act No. 17/1992 Sb. on the environment and speaks of *permanently sustainable development*, although the phrase *permanently sustainable development* is generally understood to be incorrect from a linguistic and factual point of view.

Definition

Permanently sustainable development of society is development that preserves the ability of present and future generations to meet their basic living needs, without reducing the diversity of nature, and preserves the natural functions of ecosystems.

The idea of sustainable development began to take shape as early as the 19th century. The original focus of sustainability on the relationship between man and nature changed in the 1970s. A new stream of ideas emerged, promoting nature conservation over economic and social interests. The current understanding of sustainable development has seen another shift. The goals are no longer strictly environmental, the new concept of sustainable development also requires changes in the economic and social fields.

Within the European Union, sustainable development is firmly embedded in its strategy and policies. The main framework for promoting sustainable development is the European Green Deal, adopted in 2019, which emphasizes the transition to a carbon-neutral economy by 2050, the protection of biodiversity, the promotion of a circular economy and the reduction of pollution. The European Union is also pursuing the implementation of the UN Sustainable Development Goals (SDGs), emphasizing the integration of environmental, social and economic aspects in its policies and financing of sustainable projects.

Promoting sustainable development is linked to fundamental principles. These include reviving economic growth, changing the quality of growth, ensuring a sustainable level of population, protecting natural resources, reorganizing technologies, and risk management, strengthening international cooperation and reforming international relations and decision-making in relation to economic, social and environmental factors.

The above list and the above-mentioned definitions partly indicate that sustainable development consists of several thematic frameworks referred to as pillars of sustainable development. The pillars should be in balance, but they often come into conflict.

1.1.1 Pillars of sustainable development

The pillars characterizing sustainable development represent these areas:

- environmental,
- social,
- economic,
- institutional.

The environmental pillar (also referred to as the ecological pillar) is used to assess the relationship between people and the environment. It focuses on the issue of biodiversity, natural resources, and their use or on the issue of environmental pollution. It is linked to other pillars as economic and social development must not lead to tolerable environmental limits being exceeded.

The social pillar represents the direction of human society. This is one of the reasons why this pillar is now often referred to as a pillar indicating impacts on society, rather than a social pillar. Since it focuses on reducing poverty and improving social and cultural systems, the key areas are poverty, cultural heritage, intergenerational equality, or citizen participation in decision-making processes.

The economic pillar is based on capital produced by economic activity, but it also benefits from natural capital. The essence of the pillar is to maintain a high and stable level of economic growth and employment.

Currently, another pillar is being added to the three basic pillars – the institutional pillar. This is not a brand-new element, the institutional component has been mentioned in the past, but not separately, rather as part of the social pillar. The institutional pillar relates to the issue of institutional capacity (or also institutional capital). Institutional capacity can be characterized as "*the ability of public administration bodies as representatives and promoters of the public interest to respond competently to changes in the environment.*" This pillar is associated with conflicts, the essence of which is to determine which institutions are responsible for certain goals of sustainable development and at what level. This situation is partly due to the shift from hierarchical government to public administration. This increases the importance of the powers conferred on individual public administration institutions.

The outlined multidisciplinary issues of sustainable development require involving a wide range of interest groups and addressing very diverse issues. One of the issues that is closely linked to the process of sustainable development is transport. It can contribute to or be an obstacle to sustainable development, as it is reflected in all the above-mentioned pillars.

1.2 CHARACTERISTICS OF SUSTAINABLE TRANSPORT

Transport is understood as the movement of people, goods, information, energy, and waste accomplished by available means, including walking. Transport that is in line with the principles of sustainable development, i.e. energy- and space-efficient transport, providing mobility opportunities for a wide range of users, transport and social safety and reliability, promoting a healthy lifestyle and economic and social cohesion, is often referred to as sustainable transport.

The idea of sustainable transport is closely linked to the three-market model. Sustainable transport in the context of the three-market model involves a comprehensive approach to mobility management that considers the specificities of each level:

- In the activity market, where the demand for transport is generated by human activity, urban and regional planning plays a key role, promoting the reduction of transport distances, the availability of services and goods, and thus the reduction of mobility needs.
- The transport market, in which demand and supply for transport services clash, requires the creation of efficient, environmentally friendly, and socially accessible systems that allow the preference of public and shared transport over individual car transport.
- In a traffic market where demand for specific services clashes with existing infrastructure, it is important to minimize negative impacts such as emissions, noise or congestion. This can be achieved by smart traffic management, optimizing traffic flows through modern technologies (e.g. Intelligent Transport Systems - ITS) and investing in sustainable infrastructure that promotes safety and reduces environmental burdens.

This integrated approach enables the principles of sustainability to be implemented in all aspects of the transport system.

The concept of sustainable transport is based on a combination of micro and macro factors. As is the case with sustainable development, there is no generally accepted definition. Sustainable transport can be understood as the ability to meet the primary mobility needs of people or goods without sacrificing important human or environmental values today or in the future.

Forms of transport that are generally perceived as sustainable include, for example:

- non-motorized transport – includes walking and bicycling,
- rail transport – within and outside municipalities.

The following seem appropriate in the context of sustainability:

- use of public transport and formation of integrated transport systems
- formation of combined systems in passenger transport,
- support for combined freight transport.

1.3 CHARACTERISTICS OF SUSTAINABLE MOBILITY

Geographical mobility can be understood as the ability to move. In relation to passenger transport, it can be defined as the ability of an individual to use a transport system.

Mobility defined as the ability to move and thus achieve goals is referred to as potential mobility. This ability is limited by three partial restrictions. These are the availability of transport systems, which can affect the potential for action, the skills of the individual (sometimes referred to as freedom of action) and the means that will affect accessibility. The accomplished mobility is based on the restrictions, indicating the actual achievement of the goals within the restrictive conditions.

Mobility is closely linked to accessibility. While mobility is understood as the ability to move, accessibility is the ability to interact and is affected by the difficulty of reaching specific places or activities. The two terms – mobility and accessibility – are often confused due to the close interrelationship.

Sustainable mobility planning is a key tool for ensuring efficient, environmentally friendly and socially inclusive transport in line with the principles of sustainable development. In the European context, the following approaches and integrated strategies are used for planning:

- A transport master plan is a spatial planning document that focuses on the analysis of the current state of transport and the design of transport infrastructure development. It deals with all components of the transport system and approaches the problem primarily from a technical point of view. It serves as a key basis for the development of other strategic documents of the city, which build on it and elaborate on its recommendations.
- Sustainable Urban Mobility Plans (SUMPs), which promote a systemic approach to transport development in urban agglomerations. These plans include measures to promote non-motorized transport, public transport, and shared transport services, thereby contributing to reducing emissions and improving quality of life.
- For specific aspects of logistics, Sustainable Urban Logistics Plans (SULPs) are applied, which focus on optimizing freight transport and supply chains with minimal impact on the urban environment.
- Another tool is the Sustainable Mobility Framework (SUMF), which provides a broader framework for mobility planning at local, regional and, where appropriate, national level, with an emphasis on connecting modes of transport, reducing dependence on fossil fuels and enhancing transport safety and accessibility.
- The SUMF will focus on public transport and will result in a comprehensive analysis, drafting of visions and objectives, and the identification of concrete measures. These proposals will be developed up to the level of an action plan, which includes a list of projects accompanied by an estimate of financial costs and a timetable for implementation.

These strategic approaches emphasize public participation and the cooperation of all stakeholders, thus ensuring long-term sustainability and acceptance of appropriate sustainable transport and mobility measures.

Concepts to remember

Sustainable development, sustainable transport, pillars of sustainable development, sustainable mobility.

Conflicts arise between the individual pillars of sustainable development, resulting from the different direction of individual areas. An example of a conflict is the Erika tanker accident. The single-shell tanker Erika, registered in Malta, sank in 1999 near the European coast, causing serious pollution of the sea and the coast. In relation to the pillars of sustainable development, it can be stated that oil transportation, as an important economic activity, relates to the economic pillar of sustainable development (in the context of globalization, economic growth, and capital formation). This incident along with others (e.g. Prestige oil spill) negatively impacted the environment and thus significantly affected the environmental pillar. The impact of these events is further reflected in the institutional pillar as significant packages of EU legislation have been put in place in response to the events to increase the level of maritime safety.

Summary

A sustainable transport system provides safe, economically viable and socially acceptable access to people, places, goods, and services, meets generally acceptable hygiene and environmental limits, protects ecosystems, and does not exacerbate adverse global phenomena.

Ideas to contemplate

Think about what we can understand today as unsustainable development – what causes it.

Basic literature, compulsory literature to study

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United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable Development. Retrieved from https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

World Commission on Environment and Development. (1987). Our Common Future. Oxford University Press. Retrieved from https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Review

1. Characterize sustainable development.
2. What is the relationship between sustainable development and sustainable transport?
3. Briefly describe the basic pillars of sustainable development.
4. Summarize the basic characteristics of sustainable mobility.
5. Exemplify the differences between mobility and accessibility.

2 ENVIRONMENTAL PILLAR

Introduction

The environmental area is the longest-standing issue discussed in the context of sustainable development. Its link to transport – in the context of negative externalities arising from transport – is a frequently discussed issue.

Your goals

The goal is to get acquainted with the basic characteristics of the environmental pillar, with the areas that are addressed within the topic and with the relationship of the pillar to sustainable transport.

2.1 CHARACTERISTICS OF THE PILLAR

The environmental pillar generally focuses on reducing pollution, consideration in the extraction and consumption of non-renewable resources, protecting rare ecosystems or combating climate change. Emphasis is placed on respecting the basic principles, including:

- a long-term perspective, based on the idea that the time scale of natural processes may be completely different, often much longer than people are willing and able to consider in various contexts,
- a spatial perspective that builds on the global interconnection of phenomena and their impacts and the difficulty of understanding these links,
- precautionary approach, which is based on a detailed knowledge of the impacts of human activity, due to concerns about the irreversibility of changes (for example, in transport in connection with the planning of transport structures and subsequent assessment of the impacts of their operation),
- minimization of space requirements, which is based on the understanding of space as a final source,
- risk minimization and the use of risk analysis.

To achieve sustainable development, it is necessary to respect the conditions set within the pillar:

- the intensity of the use of renewable natural resources should not exceed their regeneration,
- the intensity of the use of non-renewable natural resources should not exceed the rate of development of their replacement,
- the intensity of pollution should not exceed the assimilation capacity of the environment.

The current development in the field of transport disrupts the fulfilment of these conditions. Transport generates several phenomena that can be identified as negative externalities. Externality in general is the result of economic activity which its originator cannot (completely) appropriate (in the case of utility) or which cannot be (completely) recovered therefrom (in the case of cargo). It is possible to distinguish between positive externalities (external benefits) if the activity of one entity brings a positive effect and increased benefit to other entities without

consideration/quid pro quo and negative externalities (external costs) if the activity of one entity causes a negative effect and cost to other entities.

Negative externalities associated with transport include:

- traffic accidents,
- traffic congestion,
- land take,
- landscape fragmentation,
- barrier effect,
- vibration,
- noise,
- exhalation,
- waste generated by transport.

Two different regulatory measures – economic or normative instruments – can be used to address the issue of negative externalities.

Normative instruments include legislative and regulatory measures that set requirements and rules for the operation of transport. The aim of these instruments is to ensure compliance with environmental, safety and social standards. They may include, for example:

- laws that define frameworks for the development and implementation of sustainable transport, such as regulation of greenhouse gas emissions from transport vehicles or obligations for urban areas to develop public transport,
- technical standards that set standards for vehicles and infrastructure, such as emission standards for cars,
- regulations on vehicle use, which are restrictions on individual car use (e.g. low emission zones or parking restrictions).

Economic instruments aim to incentivize individuals, businesses, and institutions to behave in a way that promotes sustainable transport through financial incentives or penalties. Examples include:

- taxes and fees, which may take the form of charges for entering urban areas (tolls),
- subsidies and grants, which are financial support for the purchase of vehicles (e.g. electric vehicles), investment in the development of public transport, or subsidies for the construction of cycle paths and infrastructure projects aimed at sustainable mobility,
- market-based instruments and emissions trading mechanisms, such as emission allowance schemes.

Normative and economic instruments are often complementary. Normative instruments set the framework and rules for behavior, while economic instruments provide incentives for compliance or for switching to more sustainable modes of transport.

Due to their predominant positive impacts (for example, minimizing the total social costs necessary to achieve the set effect, generating public budget revenues or motivating the user), economic instruments are used to a greater extent than normative instruments. The most

common tools used, for example, to regulate road traffic in cities include congestion charges, mileage-based user fees, parking fees and restrictions on parking spaces, the introduction of pollution charges or subsidies to promote alternative modes of transport.

2.2 EXAMPLES OF GOOD PRACTICE

Measures to support the environmental pillar of sustainable transport include various strategies to reduce the negative environmental impacts of transport. Measures used include the following.

- Urban access regulations - the introduction of restrictive measures such as low emission zones, pedestrian zones and restricted zones help to limit vehicle entry and reduce emissions. Economic instruments such as urban tolls further incentivize driving restrictions in selected areas and encourage the use of alternative modes of transport. However, it is important to consider the rebound effect, i.e. the undesirable effect whereby lower traffic density can retroactively encourage more car use.
- Superblocks - this model involves a one-way street layout, limited parking mainly for residents and reduced speeds. Superblocks lead to reduce through traffic, improve safety, and provide better conditions for pedestrians and cyclists, contributing to a better urban environment.
- Incentive measures - eco-route planning options (e.g. Google Maps eco routes) and information campaigns such as "Biking to Work" motivate residents to choose more environmentally friendly modes of transport and reduce their individual carbon footprint.

The combination of these measures can contribute significantly to greener cities, reduced emissions and a more pleasant and healthier urban environment. The environmental pillar of sustainable transport therefore aims to minimize the negative environmental impacts of transport and promotes transport infrastructure and systems that are environmentally friendly and sustainable in the long term.

2.2.1 Illustrative case study

A city of 80,000 people was facing a decline in small business sales in its downtown area due to congested automobile traffic that disadvantaged pedestrian areas. Most residents preferred to shop at malls outside the city center where there was convenient access by car.

The project aimed to increase the proportion of walking and cycling to the center, support local businesses and reduce the environmental footprint associated with transport. The environmental footprint of transport refers to the overall environmental impact of transport activities. It includes greenhouse gas emissions (e.g. CO_2), air pollution from fine particles and other pollutants, noise pollution, energy consumption (fossil fuels and electricity) and negative impacts on the landscape such as land take for infrastructure or water pollution.

A thorough analysis of the current situation in the city was carried out before the changes were initiated. A survey of residents and businesses was carried out. Residents reported that it was difficult to travel to the center on foot or by bicycle due to the lack of infrastructure, noise and

pollution. Businesses pointed to a decline in footfall, particularly due to competition from shopping centers with convenient parking.

Traffic congestion was also mapped. Areas of high car traffic density were identified where emissions, noise and congestion impeded pedestrian and cyclist movement. These externalities were most prevalent in the city center.

At the same time, an environmental footprint assessment was carried out. Measurements of emissions in the city center showed that traffic was the main source of greenhouse gases, noise and particulate matter. These findings confirmed the need to reduce automobile traffic and promote more environmentally friendly transportation modes.

Based on the analysis, both hard and soft measures were implemented. Hard measures in sustainable transport refer to physical or technical changes in infrastructure or regulations that have a direct and measurable impact on the behavior of transport users. These interventions are usually costly, require longer planning and are often permanent. In this case, pedestrian and cycle zone extensions were among those implemented. Two main streets were converted into pedestrian zones with benches, green spaces, and bike racks. Dedicated cycle lanes, pedestrian crossings and safety lighting were created on other streets. At the same time, green areas were landscaped in the city. New trees and shrubs were planted in the center, creating pleasant resting places, and improving the microclimate.

Soft measures focus on influencing people's behavior, attitudes and preferences through information, motivation, or education. They are often less costly and flexible, and their effectiveness depends on the cooperation and involvement of residents. In the case of the city in question, a 'Cycle to the city center' campaign was introduced, where customers using walking or cycling transport received discounts in local shops and restaurants. Small businesses also offered special events to encourage footfall.

Positive economic impacts have been recorded following the implementation of the changes. Businesses whose establishments were more visible and accessible to pedestrians experienced positive impacts. At the same time, the environmental footprint of the town center was significantly reduced. Emissions and noise have decreased, improving the quality of life for residents, and creating a more attractive environment for visitors. Public green spaces and pleasant surroundings have attracted more families and tourists, reinforcing the importance of the center as a key point in urban life.

The project to promote active mobility has shown that well-planned measures can have a positive impact on both the local economy and the environmental footprint. Making walking and cycling more attractive has revitalized the town center, supported small businesses, and contributed to sustainable development.

Concepts to remember

Precautionary approach, externalities, regulatory measures, economic instruments, normative instruments.

The local reduction of negative externalities associated with transport can be exemplified by a city logistics solution within the FREVUE project (Freight Electric Vehicles in Urban Europe). As part of this project, special conditions for freight transport by electric vehicles were introduced in Amsterdam. The city actively supported emission-free logistics with exemptions from traffic regulations applicable to conventional trucks. One of the measures allowed a total of twenty electric vehicles from seven different operators to be exempted from parking bans in designated areas, allowing loading and unloading on the pavement directly at the destination. Exceptions also allowed electric lorries to enter certain pedestrian zones. The solution was evaluated as beneficial in economic and environmental terms and in relation to the traffic behavior of users.

Summary

The environmental pillar is focused on the development of the environment. The goal is to make sure that material, energy, and human flows meet the basic conditions of sustainable development, i.e. that the intensity of use of renewable natural resources does not exceed their regeneration, the intensity of use of non-renewable natural resources does not exceed the rate of development of their replacement and pollution intensity does not exceed assimilative capacity of the environment.

Ideas to contemplate

Think about the use of offset projects, which should ensure a global offsetting of the effects of negative externalities.

Basic literature, compulsory literature to study

European Commission. (2020). Sustainable and Smart Mobility Strategy: Putting European transport on track for the future. Retrieved from https://transport.ec.europa.eu/transport-themes/mobility-strategy_en

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Review

1. Describe the environmental pillar of sustainable development in general.
2. Give an example of negative externalities related to transport.
3. Give an example of a regulatory measure.
4. How to apply the precautionary principle in transport?
5. State how to understand the concept of externality.

3 ECONOMIC PILLAR

Introduction

The economic pillar is the area in which development is most often identified with growth. In the field of transport, it reflects the effort to support economic growth, but also to reduce the negative effects of transport on the environment – this strategy is referred to as decoupling.

This principle is key to achieving sustainable development, as it allows the economy to develop without increasing the consumption of natural resources or exacerbating environmental pressures such as greenhouse gas emissions, pollution, or ecosystem degradation.

Your goals

The goal is to get acquainted with the basic characteristics of the economic pillar, with the areas that are addressed in the topic, and with the relationship of the pillar to sustainable transport.

3.1 CHARACTERISTICS OF THE PILLAR

The economic pillar focuses on economic growth, unemployment, international trade, globalization, regional development, and business organization in relation to the other pillars.

The concept of sustainable development is sometimes mistakenly associated only with environmental protection. It is based on finding a balance between all the components of society, of which the economic sphere is an integral part. Healthy economic growth should create sufficient means to protect the environment (minimize the occurrence and consequences of negative phenomena resulting from human activity) and, conversely, a healthy environment should not limit economic growth.

It is in the economic pillar that development is often identified with growth, so the most common indicator characterizing this pillar is gross domestic product. In relation to the overall concept of sustainable development, this macroeconomic indicator has fundamental limitations resulting from its construction – it includes, without distinction, both activities contributing to sustainable development and activities whose consequences clearly worsen the quality of life or the environment.

Transport as one of the economic activities is included in the pillar – it has a significant place in the economy. Transport is crucial for labour migration, for the ability to transport raw materials and goods or the ability to provide services at the desired location. To measure and evaluate the importance of transport within the pillar, we can use, for example:

- density of transport infrastructure in the selected area since a sufficiently dense transport infrastructure is a prerequisite for economic and social growth,
- freight transport per thousand monetary units of gross domestic product,
- number of passengers transported in public transport since passenger transport is important from an economic point of view, especially for labour mobility.

Economic activity in transport is associated with another essential characteristic of this pillar – the formation and use of capital. The private and public sectors participate therein. Within the

activities of the public sector, public capital in relation to sustainable development is used as a source for protection against the occurrence or consequences of negative phenomena of economic activities and as a source for financing innovation processes leading to sustainable development.

When using public capital within the economic pillar, effective decisions on the allocation of resources are monitored. The allocation of resources should comply with the 3E principle arising in the Czech Republic from Act No. 320/2001 Sb., On Financial Control in Public Administration. The principle includes:

- economy, which is understood as the use of public funds to ensure the set tasks with the lowest possible expenditure of these funds, while maintaining the appropriate quality of tasks performed,
- efficiency, which is understood as the use of public funds that will ensure the optimal degree of achievement of objectives in the performance of set tasks,
- effectiveness, which is understood as the use of public funds that achieve the highest possible scope, quality and benefit of the tasks performed in comparison with the volume of funds spent to fulfil them.

At the same time, the allocation of resources emphasizes the financing of sustainable activities. Funding for sustainable activities within the European Union is promoted through a taxonomy that sets out criteria for identifying economic activities that contribute to achieving environmental objectives, including reducing greenhouse gas emissions, and improving energy efficiency. The EU taxonomy provides a clear framework for investors, businesses, and governments to allocate funds to projects that promote sustainable development.

In the context of sustainable transport, this means supporting investment in low and zero emission transport systems such as electric vehicles, public transport, cycling infrastructure and technologies for efficient management of transport networks. Securing funding for these projects is key to transforming the transport sector towards environmentally friendly and sustainable solutions.

3.2 EXAMPLES OF GOOD PRACTICE

Support for the economic pillar of sustainable transport focuses on measures that contribute to efficiency and economic growth through innovative transport solutions. Measures used include the following.

- Cargo bikes for last mile transport - this concept uses conventional and electric bikes to transport shipments over short distances. It is particularly suitable for urban areas where it can be combined with crowdshipping (using local couriers). Benefits include reduced transport costs and reduced emissions in the city.
- Supporting city logistics - to make urban supply more efficient, consolidation centers or micro-hubs can be built where goods are regrouped and optimized for further distribution. Dedicated supply areas in historic city centers allow for better use of street space, increase safety, and make streets easier to navigate.

- Intelligent transport systems - smart solutions such as smart parking with sensors or dynamic pricing, carsharing, bike-sharing and Demand Responsive Transport increase transport efficiency. These measures reduce operating costs, contribute to smoother traffic flow, and reduce the burden on the environment.

Overall, these measures promote sustainable and cost-effective transport that meets the needs of modern cities and brings economic benefits to their residents and businesses.

3.2.1 Illustrative case study

A city with a population of 100,000 has historically faced growing environmental and social problems associated with a high dependence on automobile transport. Traffic was a major source of greenhouse gas emissions, noise, and congestion, which negatively affected the quality of life of residents and slowed economic development. The aim of the project was to decouple traffic growth from negative environmental impacts (decoupling of traffic) and to create a sustainable urban mobility system.

First, an analysis of the existing traffic situation was carried out, which included an analysis of road traffic load, major emission sources and traffic flows in problematic areas such as the city center and residential zones. Opportunities were then identified to reduce car traffic through improved public transport accessibility and pedestrian and cycling infrastructure. The application of low emission technologies, including shared electric vehicles and hybrid buses, and the use of transport applications to optimize flows were also assessed.

The strategy to bring about change included several key measures. These included expanding public transport by improving bus route coverage, introducing night services, and reducing fares. There was also financial support for cycling and pedestrian mobility - particularly the construction of cycle lanes, pavements, and the installation of safety features, including better lighting and crossings. In addition to passenger transport, freight transport was also addressed, with innovative solutions using distribution centers on the outskirts of the city to reduce freight traffic in the center.

The use of financial instruments was an integral part of the changes. These included incentives for switching to environmentally friendly transport, including tax breaks, and higher entry fees for vehicles with internal combustion engines.

The measures introduced were continuously monitored and evaluated. Changes in the number of vehicles, emissions, and the use of alternative modes of transport were monitored. Based on resident feedback and results, the strategy was continuously adjusted to maximize effectiveness.

Within a few years, air quality improved, noise reduced, and residents expressed greater satisfaction with urban mobility. The traffic decoupling project has demonstrated that it is possible to achieve economic growth without a corresponding increase in car traffic and has brought greater sustainability and quality of life improvements to the city.

Concepts to remember

Gross domestic product, capital, 3E principle.

The conflict between the environmental aspect of sustainable development and the economic aspect can be illustrated, for example, by the emissions trading system. Emission allowances are the main instrument of the European Emissions Trading System (EU ETS), which aims to reduce greenhouse gas emissions through charging. Each allowance gives the holder the right to emit one ton of CO_2 or the equivalent amount of N_2O or perfluorocarbons. The EU issues a certain amount of these allowances every year, which has been decreasing steadily over the years in line with the EU's emissions targets. The system thus makes it possible to control and continuously reduce the volume of emissions from the sectors covered. Entities that have the option to reduce emissions at a lower cost may sell the saved allowances or other emission credits to those for whom such a reduction would be more costly.

Summary

The economic pillar is based on capital produced by economic activity, but it also benefits from natural capital. The economic side of sustainability deals primarily with the issue of economic growth and seeks ways to achieve this growth.

Ideas to contemplate

Think of alternative indicators that could be used instead of gross domestic product to measure development.

Basic literature, compulsory literature to study

Button, K. (2010). Transport Economics. Cheltenham: Edward Elgar Publishing.

European Commission. (2024). EU Transport in Figures: Statistical Pocketbook 2024. Retrieved from https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook_en

European Commission. (2024). Transport in the European Union: Current Trends and Issues. Retrieved from https://trimis.ec.europa.eu/documents/transport-european-union-current-trends-and-issues-0

Review

1. Describe the economic pillar in general.
2. Describe the importance of transport within the economic pillar.
3. State the disadvantage of the gross domestic product indicator as a measure for assessing development.
4. Describe the 3E principle.
5. How can the term efficiency be understood in the context of the 3E principle?

4 SOCIAL PILLAR

Introduction

The social pillar focuses primarily on the standard of living of the individual and the issue of social cohesion. In the field of transport, these issues are related to mobility and the need to ensure its provision for all users, considering their possible limitations.

Your goals

The goal is to get acquainted with the basic characteristics of the social pillar, with the areas that are addressed in the topic and with the relationship of the pillar to sustainable transport.

4.1 CHARACTERISTICS OF THE PILLAR

The pillar focuses mainly on cohesion between generations or social groups, equal rights, access to education or poverty reduction.

Cohesion and equal rights are issues closely linked to the availability of transport and the exclusion from transport – social exclusion. Social exclusion is a social process. This process means that some individuals in society cannot participate in the usual activities. It is a dynamic process since the concept of routine activities changes over time. This concept depends on progress, technology and demands.

Factors that influence access to mobility and exclusion include, for example, belonging to a social group, gender, or age. These factors are affected by physical or concern exclusion. The groups most at risk of social exclusion include women, children, young people, people living in single households, people with low education or low incomes. It can be assumed that these individual and family characteristics influence the choice of living and working location, activities, travel decisions and the choice of transport modes for travel. To these characteristics are added circumstances that individuals cannot influence. These include, for example, the availability of transport and the associated geographical exclusion, spatial exclusion, and exclusion from the use of the facility.

Mobility is closely linked to accessibility/availability. While the mobility of people is understood as the ability to move, accessibility is the ability to interact and is affected by the difficulty of reaching specific places or activities. The exclusion deepens/weakens with the impossibility/possibility of owning a car. Owning a car is an opportunity to adapt to the limited availability of public transport. The possibility of adaptation is to some extent individual. The extent to which individuals who do not own a car are disadvantaged in relation to car owners can be measured by mobility gap analysis.

Economic exclusion also plays an important role. This is related to the affordability of services and the cost of mobility.

The right to adequate, high-quality, and safe mobility of people is understood in the EU as one of the fundamental rights. Mobility of persons is highly valued for its economic and social benefits,

and at the social level it is important for meeting basic needs as well as for strengthening social ties and interactions.
Ensuring at least a basic level of mobility is linked to public services. The public transport system is an important aspect of social policy, but also of the sustainable development of urban agglomerations and balanced regional development.

The practical implementation of public services in this area in the Czech Republic is the provision of services within the scope of transport services/accessibility. Transport services in the EU are regulated by Regulation No. 1370/2007 of the European Parliament and of the Council on public passenger transport services by rail and by road. Under Czech law, transport services are defined by Act No. 194/2010 Sb., On public passenger transport services, as follows: " *Transport services shall mean the provision of transport on all days of the week, in particular to schools and school establishments, public authorities, employment, medical establishments providing basic health care and the satisfaction of cultural, recreational and social needs, including return transport, contributing to sustainable development of the territorial district.*"

A second important theme that the transport pillar focuses on is promoting active mobility (and thus reducing physical inactivity). Active mobility, including walking and cycling, plays a key role in supporting the social pillar of sustainability, as it improves quality of life, promotes the health of residents and creates more inclusive public spaces. Unlike micro-mobility, which involves the use of small electric vehicles such as scooters or electric bicycles, active mobility requires no energy sources and is entirely dependent on human power, thus further reducing the environmental footprint of consumption.

Investing in safe and well-connected infrastructure such as sidewalks, cycle paths and crossings is key to promoting active mobility, but also in educating the public about its benefits and changing urban planning to create 'short distance' cities.

Focusing on both above areas - ensuring inclusion and ensuring active mobility - contribute to increasing physical activity, building social connections and reducing transport segregation, which together strengthen the sustainability of society and equality of access to mobility.

4.2 EXAMPLES OF GOOD PRACTICE

Support for the social pillar of sustainable transport focuses on measures that improve mobility, health, and safety of the population. Measures used include the following.

- Promoting active mobility, which includes promoting walking, encouraging cycling as well as micro-mobility.
    - Walking - improving infrastructure and pedestrian connections (e.g. parking and P+G walking routes), which motivates citizens to choose to walk.
    - Cycling - building cycle routes and providing links such as B+R (Bike and Ride) to make cycling an easily accessible alternative.
    - Micromobility - developing infrastructure and setting rules for shared micromobility (scooters, e-bikes) encourages fast and flexible transport over short distances.

- Promoting public transport in the form of interconnections with individual transport using worthy parking systems such as P+R (Park and Ride) and K+R (Kiss and Ride) to facilitate the transition between public transport and private cars. In addition, it is also possible to include the promotion of public transport efficiency, which can be achieved, for example, by introducing bus lanes and BRT (Bus Rapid Transport) systems. All of this increases the speed and efficiency of public transport.
- Improving safety, which should include safety for active mobility (various organizational, technical, and psychological measures to calm traffic provide a safer environment for pedestrians and cyclists. And safety in public transport, including improved safety standards in stations, bus stops and means of transport, which increases the feeling of safety and encourages the use of public transport.

These measures contribute to a transport system that is sustainable and beneficial to people's health and quality of life.

4.2.1 Illustrative case study

The city, with a population of approximately 50,000, was facing increasing traffic problems, including peak hour congestion, increased emissions, noise pollution and frequent traffic accidents. The aim was to calm traffic, improve safety and encourage sustainable modes of transport such as cycling, walking and public transport.

A detailed analysis of traffic density, accident mapping and the identification of black spots were carried out. Black spots are specific locations on the road network that are characterized by a high concentration of accidents, often with serious consequences. These locations have been identified based on accident statistics and their occurrence has been linked to problematic traffic design, poor infrastructure, or increased movement of vulnerable road users such as pedestrians and cyclists.

Typical examples of black spots were identified, such as opaque junctions, narrow or unmarked pedestrian crossings, sections with unclear road signs, poorly lit sections, or bends with limited visibility.

Critical areas included busy stretches near schools, parks, and residential areas where there are many pedestrians and cyclists.

Based on the results of the analysis, appropriate solutions to promote traffic calming were proposed and applied. These included the introduction of deceleration features such as speed bumps and 'Zone 30', improvements to cycling and pedestrian infrastructure, the introduction of one-way streets in narrow centers and the reduction of individual traffic through the introduction of restricted parking zones and higher parking charges in the center. At the same time, public transport and active mobility were promoted by creating pedestrian and green zones to exclude car traffic.

Resident education and participation were an integral part of the changes. Information campaigns on the benefits of sustainable modes of transport were implemented. The public was kept informed about changes in the transport system and their benefits for safety, health, and the environment.

Regular monitoring of traffic loads, emissions and safety in key areas was introduced in response to the changes. Emphasis was placed on gathering feedback from residents and adjusting measures according to their needs and comments.

The result of these actions has been to reduce traffic accidents, emissions, and noise pollution, while improving the quality of life of residents by promoting sustainable forms of transport.

Concepts to remember

Mobility, accessibility/availability, social exclusion, transport services/accessibility, active mobility, micromobility

The social dimension of sustainable transport is focused on the issue of ensuring mobility for all user groups. Special attention needs to be paid to transport users who may be at risk of social exclusion. These users may include people with disabilities. According to Eurostat, out of the total number of people with disabilities in the EU, 30.2% (i.e. about 31 million people) were at risk of poverty or social exclusion in 2015. The risk of exclusion increases with the severity of the disability.

Summary

The social pillar emphasizes human needs and quality of life. It includes an intragenerational aspect, which is understood as meeting the current needs of an individual or group of individuals without currently compromising the values of another individual or group of individuals. And it is also naturally based on the idea of sustainable development and respects the intergenerational aspect.

Ideas to contemplate

Think about the impact of a situation in which we would evaluate transport services solely in terms of their economic viability.

Basic literature, compulsory literature to study

Banister, D. (2008). *The Sustainable Mobility Paradigm*. London: Routledge.

European Commission. (2024). Social issues, equality and attractiveness of the transport sector. Retrieved from https://transport.ec.europa.eu/transport-themes/social-issues-equality-and-attractiveness-transport-sector_en

European Economic and Social Committee. (2011). Social aspects of EU Transport Policy. Retrieved from https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/social-aspects-eu-transport-policy

Review

1. Describe the concept of social exclusion.
2. Give an example of factors that can cause social exclusion.
3. State how to understand the concept of mobility.
4. Give an example of a group of users at risk of social exclusion.
5. Characterize the transport services/accessibility.

5 INSTITUTIONAL PILLAR

Introduction

In general, the institutional pillar represents the activity of the public sector, the identification of areas of public interest and the procedures for their fulfilment. In the field of transport, the institutional pillar is very closely linked to the social pillar and the issue of ensuring mobility.

Your goals

The goal is to get acquainted with the basic characteristics of the institutional pillar, with the areas that are addressed in the topic, and with the relationship of the pillar to sustainable transport.

5.1 CHARACTERISTICS OF THE PILLAR

Governance is the last pillar and an extension of the traditional economic, social, and environmental pillar to another dimension. That is a high-quality state administration and self-governance with the ability to respond flexibly to the changing needs of society. Separation into a pillar emphasizes the importance of high efficiency of state administration and self-government for the good functioning of society. Its role is emphasized as the speed and form of implementing the ideas of sustainable development seem to be increasingly important.

Institutions acting within the public administration are usually characterized by specific functions and associated with specific tasks that should be performed independently or in interaction with others. Institutions are understood here as formal and informal systems of rules for authoritative conflict resolution purposes, while also having mechanisms for enforcing the rules.

The public sector is a specific part of the economy, a part of the services sector. The core of the public sector is public administration, which consists of a system of authorities with central or territorial powers. The public sector covers those types of services that would be disadvantageous, impractical, or even impossible to provide on a commercial basis.

The structure of public administration, its financing and the position of local governments are different in each country. Public administration can be understood as a system that consists of two main subsystems: the main subsystem is the state administration, and the second subsystem is self-government. Self-governance is also an expression of decentralization and democracy. At the level of territorial public administration, there is a so-called mixed model in the Czech Republic. Both at the municipal level and at the regional level, state administration and territorial self-government are performed within a single territorial administrative unit.

Public institutions are social entities whose behavior significantly influences the behavior of people and private institutions by example. Among other things, they are important consumers of all goods and services. Organizations financed from public sources, especially from the state budget, have a crucial role to play.

Within the provision of public goods and services, it is possible to use:

- non-profit organizations and state-funded institutions/contributory organizations set up by the public sector for this purpose,
- state-owned and municipal enterprises, these are established in cases of securing such goods, which are difficult to include in market goods – the so-called semi-market goods,
- in a competitive environment through a private sector contract – for example through a tender.

The institutional pillar is closely linked to ensuring the public interest. The public interest is a concept applied primarily in public policy, public economics, ethics and law, referring to the common good and social welfare. Negatively, the public interest can be defined as the opposite of the private interest or the interest of only a certain group.

Generally, the public interest is a policy orientation that supports the development of society and the solution of its real problems. It is clear from this definition that the identification and recognition of public interests can be a source of conflict in society as ideas vary about what is good for society and what its problems are. The identified public interests do not have universal validity.

Public services and public/mixed goods are provided in the public interest. A public service is a service in the public interest that is provided or ordered and financed or co-financed by a component of public administration, i.e. the state or a territorial self-governing unit (in the country, a region or municipality). A specific feature thereof is that if it were not financially supported by public entities, it would not be provided on the market at all or would be provided in a lower quality or scope. This term is directly related to the social consensus that certain types of services are to be available to everyone, regardless of their property and income. In the case of transport, it is possible to include transport services among such services.

Public goods, specifically pure public goods, are those activities or services that are of benefit to the whole society, do not pass through the market and are provided by public administration (state administration or territorial self-government).

Mixed goods can be characterized as goods that are divisible in their consumption, so quantity can be divided among individual consumers, but quality is indivisible up to capacity limitations. Given the quantity consumed, the quality of the good is the same for all users. As the number of users increases, the quality of the good, provided decreases for all users and the phenomenon of congestion occurs. The consumer can be excluded from consumption through a price or allocation mechanism. Exclusion is economically optimal only for quantities close to the overload threshold, i.e. when the quality begins to decline sharply. An example is transport infrastructure.

Public goods and services that support transport sustainability include infrastructure for public transport, cycle paths, sidewalks, public shared systems (e.g., bike-sharing and car-sharing), and intelligent transport systems (ITS) for efficient traffic management.

Public services also play a key role in motivating behavior change, such as subsidies for vehicles, the introduction of low-emission zones, and the promotion of integrated transport systems connecting various modes of transport.

The public sector is a key player in ensuring these goods and services. It finances, plans, and manages infrastructure, often leveraging subsidies, tax incentives, or public-private partnerships (PPP) to support environmentally appropriate innovations. Through regulatory tools such as emission limits, restrictions on car traffic in city centers, or support for multimodal transport, it influences the behavior of citizens and private companies. The public sector also ensures equal access to services, contributing to the reduction of social inequalities and the overall sustainability of transport.

In connection with transport, we can monitor:

- improving the competitiveness of state in connection with building high-quality transport infrastructure,
- provision of public services for users in the form of ordering transport services,
- ensuring the maintenance and operation of the transport infrastructure using the user's contribution on the "user pays" principle,
- securing stable sources of financing for public goods and services,
- reducing the negative impacts of transport using the "polluter pays" principle.

5.1 EXAMPLES OF GOOD PRACTICE

To support the institutional pillar of sustainable transport, measures focusing on quality public administration, effective delivery of its sustainable transport tasks and tools for planning and financing sustainable transport are appropriate. Key areas include, for example, the following.

- Ensuring sustainable financing - Sustainable transport financing is an approach to financing transport projects that considers environmental, social and economic aspects in order to promote long-term sustainable development. This type of funding channels resources to projects that have a positive impact on the environment, reduce greenhouse gas emissions, promote public and alternative transport, and improve quality of life. Sustainable financing instruments include:
    - public resources at the European Union level (e.g. operational programs) or mobility funds at the city level, or a national parafiscal fund,
    - private investment in environmentally friendly technologies with public sector support.
- Provision of transport services - transport services are the provision of accessible transport for the public through public services. This Act regulates the obligations and rules for the organization and financing of public transport to ensure the availability and quality of transport services at various levels.
- Cooperation with stakeholders - this area includes the development of mobility plans for different stakeholders. Businesses focus on reducing excessive passenger and freight transport, while public institutions and schools promote active mobility and reduce individual automobile transport (IAT).

These measures promote sustainable transport at European, national and local level and strengthen cooperation between the public sector and other partners.

5.1.1 Illustrative case study

The city of 220,000 inhabitants faced challenges related to traffic congestion, air pollution and the need to switch to more sustainable forms of transport. It therefore decided to set up a Mobility Fund to serve as a stable source of funding for projects to promote cycling, walking and electromobility.

An analysis of the legislative and financial options showed that the Mobility Fund could raise funds from a combination of sources. The Fund was designed as a multi-financing mechanism using local taxes, parking revenues and European subsidies.

The Fund primarily financed the extension of cycle and pedestrian routes. The town center was revitalized, which increased its attractiveness to visitors and residents. Part of the fund was also used to install charging stations at busy locations in the city.

The city has kept the public informed of the results through annual reports and public forums. This transparent communication has helped to gain support from residents.

The Mobility Fund has proven to be an effective tool for financing and implementing projects to promote sustainable transport. Thanks to a clear structure, stable revenues, and well-managed projects, it has succeeded in reducing emissions, revitalizing the city's economy, and improving the quality of life of residents.

Concepts to remember

Public sector, public interest, public service, public good.

Systematic measures for informed public participation in relevant decision-making levels are an essential part of the institutional framework for sustainable development. In developed countries and in many developing countries, municipalities can be considered successful supporters of the concept of sustainable development. Local Agenda 21, developed and implemented within individual municipalities, has so far been the most successful expression and actual implementation of the ideas of the Earth Summit 1992. We can monitor, for example, the share of municipalities, cities and micro-regions with a functioning Local Agenda 21 process.

Summary

The pillar is an institutional framework designed to address the challenges of sustainable development and includes a set of bodies, organizations, networks, and arrangements with varying degrees of official status that participate in policy activities – their formulation and implementation. It includes the issue of public goods and services and their provision, but also hierarchical governance. This framework needs to be considered in local, national, regional and international planning.

Ideas to contemplate

Think about the structure and interrelationships of public administration bodies in your country.

Basic literature, compulsory literature to study

European Commission. (2024). Sustainable Urban Mobility. Retrieved from https://transport.ec.europa.eu/transport-themes/sustainable-transport_en

Marsden, G., & Reardon, L. (Eds.). (2018). *Governance of the Smart Mobility Transition*. Emerald Publishing Limited.

Review

1. Characterize the public sector.
2. Characterize the public interest.
3. What is the difference between a public and a mixed good?
4. Give an example of a public service.
5. What types of organizations are involved in providing public goods or services?

6 SUSTAINABLE TRANSPORT PLANNING AND MANAGEMENT

Introduction

Within the topic of sustainable development, great attention has long been paid to the consistent setting of goals to be achieved, the setting of the management mechanism in accordance with the goals, the setting of evaluation processes for achieving the goals and, finally, the determination of feedback flows.

Your goals

The goal is to get acquainted with the basic approaches used in the planning of sustainable transport and subsequently its management and monitoring.

6.1 CHARACTERISTICS OF SUSTAINABLE MOBILITY PLANNING AND MANAGEMENT

Sustainable transport planning and management depends on empirical data. Initial data can be obtained using situation analysis. Situation analysis makes it possible to capture the essential factors that affect the current state of the phenomenon under study. Situational analysis can be implemented in four steps, which are interconnected and require the use of different sources of information:

- recognition of calls for solution by monitoring deviations of the current state from the required state in sub-areas,
- possible decomposition of calls for solution in case of complex issues,
- assessment of the importance of the identified calls for solution and determination of the order thereof according to the selected priorities,
- establishment of a solution plan, which requires the setting of objectives to be achieved under each call.

Situational analysis therefore gives us an idea of the situation and allows us to break down overlapping concepts, identify challenges to address and set their priorities. The findings of the situation analysis are the basis for strategic decisions and subsequent planning.

Planning generally emphasizes setting objectives over time and defining ways to achieve those objectives. The objectives to be achieved can be set using the S.M.A.R.T. principles. According to this method, the objectives should be formulated as specific, i.e. accurate, qualitatively, or quantitatively clearly described. Also measurable, i.e. defined in a way that allows changes in the phenomenon to be quantitatively evaluable. This requires the selection of appropriate indicators that meet the intelligibility feature. Objectives should also be achievable, i.e. created based on available financial, technical, and human resources. The last two characteristics of the objectives are related to the relevance to the phenomenon under study and the time-bound quality, i.e. a clearly defined schedule of solutions, and in the case of the objectives to their limits.

It is appropriate to set indicators for the objectives defined. The indicator can be understood as a simple empirical model of reality, which can be used to analyze and evaluate it. These are variables intended for the symbolic representation of phenomena or goals. The basic division is

into simple indicators and composite (aggregated) indicators, also referred to as indices. The index represents a newly created indicator, which consists of individual sub-indicators compiled into a single unit based on the source model. Thus, an index is the result of merging variables into a single number or file that captures their aggregate properties. This merging can be seen as positive as it can lead to a better understanding of a particular problem, but it also raises doubts as it can lead to the loss of some essential information.

The indicators are usable:

- in the planning process,
- in the decision-making process,
- in the management and monitoring process.

A plan for achieving the defined goals must be developed. Sustainable transport planning requires a comprehensive approach that combines integrated, long-term, and participatory strategies. Integrated planning means that transport is not addressed in isolation, but as part of broader plans covering urban development, environment, public health, and social inclusion. This approach promotes coordination between different sectors such as transport, urban planning, and energy, allowing for efficient allocation of resources and synergies. For example, the introduction of cycling and walking infrastructure can be linked to the revitalization of urban centers or the improvement of air quality.

Long- and short-term planning is a key aspect in creating a sustainable transport system. It is important to distinguish between strategic plans that focus on future development and operational changes that respond to current needs. Strategic tools such as Transit-Oriented Development (TOD) encourage the concentration of development around public transport nodes and reduce dependence on individual car travel. Operational measures such as optimizing public transport routes or introducing low emission zones, on the other hand, serve to immediately improve the functionality and sustainability of the system.

Participatory planning, based on the involvement of a wide range of stakeholders, including the public, experts, and local authorities, brings key value to the success and legitimacy of transport plans. Methodologies such as Avoid-Shift-Improve (A-S-I) allow for structured engagement of different stakeholders, with an emphasis on preventing unnecessary trips (Avoid), shifting to more sustainable modes (Shift) and improving the efficiency of transport systems (Improve). The participatory approach not only promotes the development of realistic and widely accepted plans, but also raises awareness of the need for sustainability among citizens.

By combining these approaches, cities and regions can effectively plan and implement transport that meets current and future sustainability challenges.

The planned procedure is then implemented, and its implementation requires appropriate management. In connection with the goals of sustainable transport – increasing accessibility without increasing the environmental burden on the environment – it is possible to use mobility management. Mobility management is a demand-oriented approach to transport that uses a set of tools to change transport behavior and support the sustainable development of transport.

Emphasis is placed primarily on the use of non-motorized transport for individual transport as well as on the use of public transport, car-sharing or car-pooling.

To ensure the effectiveness and sustainability of transport planning, it is necessary to carry out systematic evaluation of plans at all stages of their implementation - before the actual implementation of measures (ex-ante), during implementation and after completion (ex-post). This evaluation makes it possible to assess the expected and actual impacts of the planned measures, identify shortcomings and contribute to the optimization of future strategies.

Ex-ante and ex-post impact assessments are a key tool for anticipating and retrospectively evaluating the impacts of transport plans. Ex-ante analysis focuses on expected benefits and risks before implementation, while ex-post evaluation provides feedback on real impacts, allowing for improved practice and data-driven policy making.

One of the main evaluation methods is cost-benefit analysis (CBA), which considers the financial and non-financial costs and benefits of different measures. This method helps to determine the cost-effectiveness of projects by, for example, comparing the cost of building a cycle path with the expected benefits in terms of reduced emissions, transport savings or health benefits for residents.

Another important method is multi-criteria analysis (MCA), which allows projects to be evaluated based on a balanced set of criteria such as economic, social, and environmental aspects. This approach is particularly useful when different priorities need to be balanced, such as accessibility to transport for different groups of people, while minimizing environmental impacts.

Life Cycle Assessment (LCA) plays a key role in assessing the overall environmental footprint of a measure. LCA analyses the environmental impacts throughout the entire life cycle of a project - from materials production through operation to disposal. This approach is essential, for example, when comparing the impacts of different types of vehicles or when deciding on the use of renewable energy sources in transport systems.

The combination of these methods provides a comprehensive view of the impacts of transport plans, promotes transparency, and enables stakeholder involvement in the assessment process. This enables the development of strategies that deliver balanced and sustainable outcomes for society and the environment.

6.1.1 Illustrative case study

The city of 100,000 inhabitants was facing growing traffic problems such as congestion, air pollution and noise, which were negatively affecting the quality of life of its residents. City leaders decided to use the A-S-I (Avoid - Shift - Improve) strategic framework to promote sustainable mobility and improve accessibility, safety, and quality of life.

The framework included reducing the need to travel (Avoid), shifting transport to more environmentally friendly forms of transport (Shift) and improving the efficiency and sustainability of existing transport modes and infrastructure (Improve).

The implementation of the measures under A-S-I was as follows:

- to address this in the context of the Avoid idea, the city partnered with local businesses and implemented programs to encourage telecommuting and flexible work hours; in addition, new shared offices were created in the outskirts of the city to minimize the need to commute to downtown,
- new cycle paths, pedestrian walkways and safe crossings were created to provide Shift; public transport was upgraded with new peak hour services and low emission vehicles,
- the Improve area has been boosted by the introduction of smart traffic lights which have reduced waiting times at major junctions, helping to reduce emissions and fuel consumption.

The A-S-I strategic framework has proven to be an effective approach to developing sustainable transport in the city. Reducing the need to travel, promoting environmentally friendly modes of transport, and improving transport efficiency have contributed to achieving environmental and social objectives and improving quality of life.

Concepts to remember

Planning, mobility management, situation analysis, indicator, index.

To monitoring in the framework of sustainable transport, the following indicators can be used:

- average daily travel time (this indicator can be constructed for individual trips and given in hours, it should include the times needed for transfers and waiting),
- reliability of transport (this indicator can be constructed as a percentage of people who must travel 10% longer than the average time),
- energy consumption (this indicator can be constructed as fuel consumption per person in passenger transport),
- expenditures of households or individual users on transport (this indicator can be constructed based on determining the relationship between total transport costs and total household expenditures).

Summary

Sustainable transport planning and management is a process in which several methods can be applied. Initial analysis provides the initial input for the process. The current state should be compared with the required goals and then steps should be proposed to achieve the goals. The implementation of individual steps is the subject of management. Management in relation to sustainable transport is an active approach to finding and applying alternative solutions to situations that are, for example, more environmentally or humanly friendly. The result should be a rational offer of mobility. It is possible to use indicators (simple or composite in the form of an index) for monitoring and evaluation of implementation.

Ideas to contemplate

Think about how setting and achieving goals within sustainable development and sustainable transport could be communicated to the general public.

Basic literature, compulsory literature to study

Banister, D. (2008). Transport Planning. London: Taylor & Francis.

European Commission. (2020). *SUMP Guidelines and Decision Makers Summary*. Urban Mobility Observatory. Retrieved from https://urban-mobility-observatory.transport.ec.europa.eu/sustainable-urban-mobility-plans/sump-guidelines-and-decision-makers-summary_en

Hull, A., Silva, C., and Bertolini, L. (2012). Accessibility Instruments for Planning Practice: Exploring Accessibility-Based Approaches for Sustainable Transport Planning. London: Routledge.

Review

1. How can mobility management be understood?
2. Give an example of at least one indicator used for monitoring in sustainable transport.
3. Compare the characteristics of an individual indicator and an index.
4. What is the purpose of the S.M.A.R.T. method?
5. What is the purpose of situation analysis?

7 THE PROJECT GUIDE

Introduction

More than 70% of the European Union's population lives in urban areas, which account for a quarter of greenhouse gas emissions from transport. Cities face a few transport challenges that affect the quality of life of their inhabitants and the overall sustainability of urban development. The main challenges include the following.

- Congestion – the increasing number of vehicles in urban areas causes frequent congestion, leading to lost time, higher transport costs and negative impacts on productivity.
- Air pollution – transport is a significant source of emissions of pollutants such as nitrogen oxides and particulate matter, which endanger the health of the population.
- Noise pollution – urban traffic generates noise that negatively affects the physical and mental health of residents, especially in densely populated areas.
- Insufficient infrastructure for sustainable transport – the lack of good quality cycle paths, pedestrian zones and an efficient public transport system often hinders the development of environmentally friendly forms of mobility.
- Social inequalities in access to mobility – not all residents have equal opportunities to use transport systems, which can exacerbate inequalities between different groups and cause social exclusion.
- Transport safety – high numbers of road accidents, especially involving pedestrians and cyclists, remain a persistent problem in urban areas. As well as objective safety, subjective safety needs to be addressed.
- Urbanization and spatial demands - Increasing urbanization and urban sprawl place significant demands on space, which is limited, making it difficult to plan transport systems effectively.
- Transitioning to zero-emission transport – increasing initiatives to reduce local CO_2 emissions and shift to cleaner technologies such as electric vehicles or shared transport, which require significant investment and infrastructure upgrades.

Cities today therefore face many challenges and are looking for new efficient transport solutions to relieve the burden on existing infrastructure, improve public space and promote sustainable modes of transport. Sustainable urban mobility seeks to find answers to how to combine the interests of the inhabitants of the urban area under consideration with safety, parking, freight solutions, public space creation with a preference for public transport, walking.

Your goals

Students should choose one traffic problem in the chosen city – in any city in your country or abroad. The problem can be related to transport, infrastructure, human behavior, or urban logistics, for example. The aim of the project will be to propose a suitable solution to this problem and briefly evaluate it.

By completing the project, students will demonstrate that they have knowledge of the general principles of sustainable transport and urban mobility and are able to apply these principles in practice.

7.1 INITIAL ANALYSIS

To prepare the first parts of the project, it is necessary to elaborate the general and traffic characteristics of the selected city.

The first part of the initial analysis should include a summary of the socio-economic and geographical characteristics of the selected city, such as:

- what important businesses are in the city,
- how the city will develop (what are the land use plans for commercial or residential suburbanization),
- what is the age structure of the population,
- how the city's population is changing over time (population growth or decline),
- what is the geographical location of the city (e.g. shape of the population center, location in the region).

The second part of the initial analysis should include an analysis of the current state of transport and mobility in the city, including the inclusion of relevant documents (infrastructure, services, conditions, city/county/national strategic materials, transport user behavior, etc.).

It is advisable to include, for example:

- how the city is connected to important transport networks (rail transport, motorway network),
- whether the city has a sustainable urban mobility plan or an urban logistics plan,
- what are the parking conditions in the city,
- what are the conditions for cyclists in the city,
- what are the conditions for transport services in the city – for example how public transport is operated,
- whether major investments are planned and how they will be financed – for example, whether bypasses are being built or important transport routes upgraded,
- what is the modal split,
- what is the commuting pattern to work or school.

Recommended sources of information include:

- European Commission – EIT Urban Mobility Study Charts Path to Sustainable Transport: Costs, Benefits, and City Case Studies to 2050,
- European Commission – EU Urban Mobility Observatory,
- European Commission – The New EU Urban Mobility Framework,
- European Commission – Topic Guide: Sustainable Urban Logistics Planning,
- European Economic and Social Committee – Opinion on the New EU Urban Mobility Framework,
- European Environment Agency – Cities Play Pivotal Roles in Europe's Sustainability Transition,
- European Investment Bank – Europe and its Urban Development, 1970 to 2020,
- European Transport Research Review – Toward an Urban Transport Sustainability Index: A European Comparison,
- European Transport Workers' Federation – Digital Transformation and Social Dialogue in Urban Public Transport in Europe,
- Eurostat – Urban-rural Europe: Demographic Developments in Cities,
- Eurostat – Urban-rural Europe: Economic Activity in Capital Cities and Metropolitan Regions,
- Statista – Economy of Europe: Statistics & Facts.

In summary:

- it is advisable to make a brief transport, socio-economic and geographical characterization of the selected city – with emphasis on the elements that influence transport demand,
- identification of the specific documents of the selected city related to sustainable development and sustainable transport, or identification of general starting points for addressing sustainable transport and transport behavior – identification of relevant strategic documents, generally applicable to cities in the European Union or in each country, related to sustainable development and sustainable transport,
- analyze the current state of transport and transport behavior within the city.

7.2 Identification of Problems or Challenges

The third part of the project should include the identification of the problem/challenge to be addressed, which will be the focus of the project.

For example, what might be the problem/challenge that the project can address?

- Freight traffic: does freight traffic enter the city even if it is not necessary because there are detour routes? And are there even detour routes?
- Parking: are there P+R, B+R, P+G in the city? Are there enough parking spaces for residents?
- Public transport: are there new residential or commercial suburbs emerging in the city that are not supported by public transport? Is public transportation used for only certain trips and why?

- Bicycling: Are only recreational bike lanes emerging but no shared space for cyclists in cities? Are there safe places to store bicycles?
- Walking: are there barriers to moving freely and safely in cities? Is the city green and pleasant to walk in (e.g. in the hot summer months)?
- Accessibility: Is transport accessible without barriers for people with disabilities? Do people with disabilities have enough appropriate information?
- Entrepreneurial activities: What are the conditions for entrepreneurship? Does transport support business development in cities – for example, is new business development linked to rail/water transport? How is town center provision planned and managed?
- Planning: is the city preparing a mobility plan? Does the city have a mobility plan, and does it respect the targets set?

The necessary task is to select the problem that the project will address (or the challenge - an area that is working in the city in a certain way and can be improved). It is advisable to describe the problem/challenge in detail. The selection of the problem/challenge to be addressed should be based on an assessment of all four pillars of sustainable transport using a multi-criteria decision-making method.

Recommended sources of information include:

- EU Urban Mobility Observatory,
- European Commission – New Guidelines for Sustainable Urban Mobility Planning,
- European Commission – SUMP Guidelines and Decision Makers Summary,
- European Commission – Sustainable Urban Mobility Planning and Monitoring,
- European Commission – Sustainable Urban Mobility Plans,
- European Commission – Sustainable Urban Mobility,
- European Commission – Urban Mobility and Accessibility.

Summary:

- based on the analysis of the current state of traffic and traffic behavior within the city and it is appropriate to identify at least three or more weak points,
- furthermore, the analysis of the identified weak points and the creation of a ranking of them using a choice of at least eight criteria (at least two criteria from each of the pillars of sustainable development should be chosen) and scoring according to the chosen criteria within the team (the form of the criteria and the choice of the evaluation method will be determined by the team members and their use must be briefly argued in the project),
- as the last step in this part, the selection of the most significant weak point must be made - for this weak point, it is possible to use, for example, a mind map to identify the causes of the problem, to identify the current impacts of the problem, to identify priorities.

7.3 PROPOSED SOLUTION

This section should focus on a practical and reasonably detailed proposal for solving the problem.

Synergistic solutions need to be developed, which may include, for example, building new infrastructure, changing the structure of public services, regulatory measures (e.g. lowering speed limits, parking, or entry restrictions), incentive measures (e.g. offering suitable alternatives for cyclists), but will also include improving user access to information or implementing SMART solutions.

The following elements should be emphasized in the proposal:

- determine whether a solution to the problem is already planned (within the city's development plans or its Sustainable Urban Mobility Plan),
- determine how to improve any planned solution (by adding its own changes on top of the solution already being prepared by the city), whether a solution needs to be created (the city itself is not yet planning such a solution),
- consider whether there are any limitations to the proposal (e.g. how the solution would be financed, whether there would be significant risks that would limit the use of the solution, etc.),
- define who would implement the solution and what priority it would have (the city itself or in cooperation with the private sector),
- define in what steps and timeframe it would be implemented (whether in the short term or over a longer period).

Recommended sources of information include:

- Changing Transport – Sustainable Urban Mobility Plan (SUMP) Toolkit,
- EU Urban Mobility Observatory – Mobility Management: Insights and Examples to Successful Implementation,
- EU Urban Mobility Observatory – SUMP Guidelines and Decision Makers Summary,
- Institute for Transportation and Development Policy (ITDP) – 10 Principles for Sustainable Urban Transport,
- Interreg Europe – EU Good Practices on Sustainable Mobility Planning and SUMP,
- United Nations Economic Commission for Europe (UNECE) – Handbook on Sustainable Urban Mobility and Spatial Planning.

Summary:

- it is necessary to prepare a proposal to eliminate the problem or reduce its impact,
- prepare a brief implementation plan, including identification of the entity responsible for implementation, identification of the timeframe for implementation, and an estimate of the financial intensity of implementation (considering both investment and operational costs).

7.4 PROPOSAL EVALUATION

The proposal should be an environmental, economic, social, and institutional assessment. All four perspectives should be included and therefore it is appropriate to consider, for example, the following questions:

- what the environmental impacts of the solution will be,
- the impact of the solution on human health,
- what will be the economic impact on business in the city,
- the impact on transport accessibility,
- the impact on passengers with reduced mobility,
- how the change will affect the development of the city.

Indicators that are commonly used as evaluation metrics in sustainable transport can also be used as inspiration for evaluation. All perspectives can be included in the Wheel of the Future method and commented on in the text.

Recommended sources of information include:

- CIVITAS – SUMI: Sustainable Urban Mobility Indicators,
- European Commission – EU Urban Mobility Observatory,
- European Commission – Sustainable Urban Mobility Indicators Benchmarking Too,
- European Commission – Sustainable Urban Mobility Planning and Monitoring,
- European Commission – Sustainable Urban Mobility Plans (SUMP) Guidelines,
- European Commission – Technical Support Related to Sustainable Urban Mobility Indicators (SUMI).

Summary:

- prepare an evaluation of the proposal using a future wheel (an estimate of the future state if the problem is not/will not be solved),
- identify an estimate of the impacts on the different pillars of sustainable transport and mobility.

CONCLUSION

The study material "Sustainable Mobility" offers a systematic treatment of the key issues related to the transition to a more sustainable transport system through the four main pillars of sustainable development – environmental, economic, social, and institutional. It includes a wide range of tools, methods and case studies that serve as a practical basis for the application of theoretical knowledge.

It has the added value of supporting the development of green knowledge and skills. The document helps to understand the issues of reducing the negative externalities of transport, optimizing the use of resources, and integrating modern technologies.

The development of skills such as planning and managing sustainable transport, analyzing transport data, or communicating with stakeholders contributes to the formation of professionals who can design and implement transport projects that reflect the needs of current and future society. The curriculum also encourages behavioral change, promoting active mobility and reducing the carbon footprint through efficient and innovative approaches.

Overall, the curriculum is a necessary step towards strengthening the competences of individuals and institutions and can thus help to achieve sustainable transport goals that are key to climate protection, economic development, and improved quality of life.

INTERPRETATION OF SELECTED CONCEPTS

Active mobility	Active mobility can include fully active mobility (completely non-motorized) such as walking or cycling. It also sometimes includes semi-active mobility such as the use of an electric bicycle, fully motorized active mobility such as segways or scooters powered by an internal combustion engine, and lastly, special purpose wheelchairs such as electric wheelchairs.
Economic growth	Economic growth is closely linked to increases in production, consumption, and resource use, and has harmful effects on the natural environment and human health. Growth is culturally, politically, and institutionally embedded. Societies must therefore rethink what growth and progress mean and their relevance to global sustainability.
Essential transport	This is the minimum amount of transport that is necessary to operate in an area to provide all the functions represented in the area (for example, to take children to primary school or to supply shops and businesses in the area).
Externalities	Externalities occur because economic agents undertake activities that have impacts on third parties. These impacts are not reflected in market transactions.
First and last mile	The first mile can be seen as the distance between public transport and the destination and the last mile as the distance between the home and public transport. The traditional transport options for the first and last mile are walking, cycling and other short-distance modes of transport such as taking the metro.
Globalization	Globalization is the term usually used to describe intercontinental economic, social, and political integration.
Green economy	A green economy is one that leads to improvements in human well-being and social equity while significantly reducing environmental risks.
Inactivity	Physical activity levels are lower than those of a healthy individual of similar age, gender, cultural and socio-economic background.
Internalization of externalities	Incorporation of externalities into market decision-making through pricing or regulatory interventions. In a narrower sense, internalization is achieved by charging polluters (for example) for the cost of the damage caused by their pollution in accordance with the polluter pays principle.
Micromobility	Micromobility is a new type of (mostly) urban mobility that involves the use of lightweight vehicles adapted for single-person travel. It can be the use of a bicycle, a small scooter, a hoverboard, an electric scooter or a skateboard.
Mobility	Mobility is the ability to move. It is to satisfy the social need to move freely, to access the community, to trade and to establish relationships. In transport, it is primarily spatial mobility – that is, the movement of people in geographic space. It is the physical relocation (moving to a destination) and the process of choosing a location.

Mobility management	Mobility management is a concept to promote sustainable transport and manage car use by changing passenger attitudes and behavior. It can be seen as a complementary, cost-effective approach that helps to improve the quality of mobility-related services.
Persons with reduced mobility	Persons with reduced mobility are all persons with a physical, mental, intellectual, or sensory disability of a permanent or temporary nature which, in interaction with various obstacles, may prevent them from making full and effective use of transport.
Positive externalities	A positive externality can be defined as an unpaid benefit enjoyed by other members of society. Many positive externalities arise as a by-product of market transactions.
Precautionary principle	The precautionary principle allows decision-makers to take precautionary measures when the scientific evidence of environmental or human health risks is uncertain and the risks are high.
Public administration	Public administration includes all activities designed to fulfil or enforce public policy.
Public enterprise	Public enterprises can be tentatively defined as a distinct government organization, whether central, state, or local, that is engaged in the production and output of goods or services for a price, and that is managed departmentally or through a separate body.
Public goods	Public goods are the benefits that accrue to society from the provision of certain public services and from the satisfaction of wants and needs, such as the elimination of pollution. Public goods need not be provided by governments or public authorities but should have the potential to be enjoyed by all, whether the end user has paid for them.
Public interest	The public interest has a dual role. On the one hand, in its broader interpretation as an expression of consumer interest, it is one of the main criteria for assessing the competition analysis of public services. On the other hand, when considered more strictly as an expression of values of a less economic nature (such as social cohesion, etc.), the public interest is related to competition policy. The public interest is both the very objective of competition policy and its external limit.
Quality of life	Quality of life (QoL) is a multidimensional phenomenon related to the overall well-being of a society or an individual.
Rebound effect	Rebound effects are reactions that reduce the beneficial effects of a new technology, or other measures taken. The efficiency improvements brought about by technology often lead to cost reductions, and this provides the opportunity to buy more services. For example, if car owners save on fuel costs due to technology, they can afford to make more trips.
Residual traffic	This is traffic that has no source or destination in the area and only passes through the area (transit traffic) or is carried by an undesirable means of transport (e.g. a very short distance journey by car instead of walking).

Services of general interest	Services of general interest are basic services that are essential for the life of the majority of the public and for which the State has a duty to ensure public standards (to defend the public interest). Services of general interest include a wide range of activities associated with large network industries such as transport and postal services.
Shared mobility	Shared mobility refers to means of transport (cars, but also, for example, bicycles, scooters or segways powered in whole or in part by human power) to which individuals have access for short-term use. It represents a new type of mobility. It is used, for example, for one-way journeys and allows users to avoid the costs of purchasing, maintaining, operating, and parking a means of transport.
Smart city	A smart city is a place where traditional networks and services are made more efficient through digital solutions for the benefit of its citizens and businesses. A smart city goes beyond the use of digital technologies to make better use of resources and reduce emissions. It means smarter urban transport networks.
Strong and weak sustainability	Weak sustainability requires that the sum of all forms of capital (natural capital and human-made capital) remains at the same level. This means that man-made capital can replace natural capital. Strong sustainability assumes no substitutability and does not allow any element of natural capital to be depleted.
Sustainable development	Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Sustainable mobility	Sustainable mobility is the ability to meet society's need for freedom of movement, access to community, trade and relationships without sacrificing other fundamental human or environmental values, now or in the future.
Sustainable transport system	A sustainable transport system is affordable, operates equitably and efficiently, offers modal choice, and supports a competitive economy and balanced regional development. A sustainable transport system reduces emissions and waste within the planet's capacity to absorb them, uses renewable resources at or below their generation and uses non-renewable resources at or below the development of renewable substitutes, while minimizing the impact on land use and noise generation.
Sustainable Urban Mobility Indicators	Sustainable Urban Mobility Indicators are a useful tool for cities and urban areas to identify the strengths and weaknesses of their mobility system and focus on areas for improvement.
Traffic management	Traffic management provides European passengers and transport operators with information on the state of the network. It identifies incidents and emergencies, implements response strategies to ensure safe and efficient use of the network and optimizes existing infrastructure.

Transport	Transport is the purposeful technological process of moving vehicles along transport routes. Transport involves the movement of an object or people from a location to a destination.
Transport infrastructure	Transport infrastructure includes roads, railways, waterways, aviation structures and related structures and facilities. It may consist of land, buildings and facilities that serve the needs of transport. It enables the movement of people, goods, and services in society.

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LIST OF ABBREVIATIONS

A-S-I	Avoid-Shift-Improve
B+R	Bike and Ride
BRT	Bus Rapid Transport
CBA	Cost-benefit analysis
CO_2	carbon dioxide
ETS	Emissions Trading Scheme
EU	European Union
IAT	Individual automobile transport
ITS	Intelligent Transport Systems
K+R	Kiss and Ride
LCA	Life Cycle Analysis
MCA	Multicriteria Analysis
OECD	Organization for Economic Co-operation and Development
P+G	Park and Go
P+R	Park and Ride
PPP	Public-private partnership
PT	Public Transport
QoL	Quality of life
SDGs	UN Sustainable Development Goals
SULP	Sustainable Urban Logistics Plans
SUMF	Sustainable Mobility Framework
SUMP	Sustainable Urban Mobility Plans
TOD	Transit-Oriented Development
UN	United Nations United Nations

UNIVERZITA PARDUBICE
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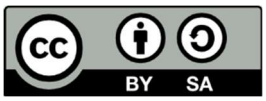

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